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Higher Education Research and Development (HERD), Estimation Model and Methodology, Statistics Canada Workshop

by Fred Gault, UNU MERIT, Maastricht, The Netherlands

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Statistics Canada
Business Special Surveys and Technology Statistics Division

Higher Education Research and Development (HERD), Estimation Model and Methodology, Statistics Canada Workshop

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Symbols

The following standard symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0s	value rounded to 0 (zer) where there is a meaningful distinction between true zero and the value that was rounded
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published

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Higher Education Research and Development (HERD), Estimation Model and Methodology, Statistics Canada Workshop

by Fred Gault, UNU MERIT, Maastricht, The Netherlands

1 Introduction

The higher education sector generates new knowledge through the performance of research and development, and it produces the highly qualified people needed to renew itself and to work in other sectors of the economy as they compete in a global market. Higher education is supported by programmes from all levels of government, by the private sector, private non-profit organizations, and by foreign institutions. Measuring the activities of the sector, the costs of their performance, and the sources of their funding, provides a means of monitoring the activities and informing policy decisions and public discourse. One of the most important activities of the higher education sector is the performance of research and development (R&D).

Higher Education Research and Development (HERD) is a third of Canadian Gross Domestic Expenditure on Research and Development (GERD), and the $10 billion of expenditure places Canada in the top ranks of countries in the Organisation for Economic Co-operation and Development (OECD), based on the HERD/GERD ratio.

This dominant position results from a series of government programmes introduced over the last decade to promote R&D in the higher education sector, with a view to increasing the production of new knowledge and the development, attraction and retention of world class researchers. These programmes include the Canada Research Chairs (CRCs), the Canada Foundation for Innovation (CFI) and the Indirect Costs Program (ICP). In addition, the budgets of the granting councils have increased over the last decade significantly and the Canadian Institutes of Health Research (CIHR) has replaced the Medical Research Council as the principal funding body for health research.

In view of the policy interest, HERD, and its funding sources, have become key statistics for monitoring the effects of the policy interventions and they are also able to support evaluation of the policies. HERD is an indicator of high policy relevance, a fact supported by the discussion of Canada's position in relation to other OECD countries which has raised questions about the methods used to estimate HERD. The response to those questions must be a clear statement of how the data quality of the indicator is to be maintained by Statistics Canada, taking account of the significant changes since the last revision a decade ago. This is not a matter of imposing burden upon the higher education sector through surveys, but of the intelligent use of administrative data and collaboration with the principal supplier of the that data, the Canadian Association of University Business Officers (CAUBO).

2 The higher education sector

The higher education sector is composed of all universities, colleges of technology and other institutes of post-secondary education, whatever their source of finance or legal status. It also includes all research institutes, experimental stations and clinics operating under the direct control of, or administered by, or associated with, the higher education establishments (Statistics Canada, 2009).

While the bulk of the R&D performance is found in the universities, research is also done in teaching hospitals and in colleges. Understanding research in hospitals is an important contribution to monitoring and evaluating policies on health research. The colleges contribute to economic competitiveness through their relations with industry as

part their R&D activities. While HERD estimates are used for the monitoring of policies of governments, they do not provide impact measues of the consequences of funding or engaging in research and development. That is quite another issue.

There are various methods for estimating expenditure on research and development and the sources of funds, such as surveys of the budget allocation of R&D performing institutions, time use surveys of personnel engaged in research to determine the percentage of their time allocated to the task, and there is the use of administrative data. Statistics Canada, following the guidelines in the Frascati Manual of the Organisation for Economic Co-operation and Development (OECD, 2002), makes maximum use of administrative data in order to minimize the reporting burden on institutions in the higher education sector. The principal administrative data source of the data, as already indicated, is the CAUBO survey. Within Statistics Canada, some data collected for other purposes on universities by the Centre for Education Statistics and on hospitals by the Health Statistics Division are used in the HERD estimation.

Any statistical mechanism for producing estimates must be reviewed at regular intervals to ensure the quality of the estimates. In the case of the HERD methodology, the last review was a decade ago (Brochu, 2000) and there have been significant changes in funding and ways of performing R&D since then. As a result, the technical workshop on *Estimates of Research and Development in the Higher Education Sector (HERD)* was held in Ottawa on October 16, 2009 as a first step in assessing the magnitude of any needed revision to the estimating procedures and their implications for data quality.[1]

3 The workshop

The workshop gathered experts and data users to review and advise on the methods used to estimate HERD. The agenda is provided in Appendix 1 and the participants are listed in Appendix 2. The participants came from universities and colleges, from granting councils and from provincial and federal government departments. CAUBO was represented as were the universities by the Association of Universities and Colleges of Canada (AUCC) and the polytechnics by Polytechnics Canada.

The presentations included a review of the issues (Hamdani, 2009) and of the recommendations of the last working group to address the revision of the estimation procedures (Brochu, 2000). These presentation introduced the components of the problem such as the treatment of sponsored research and non-sponsored research, the latter using a 1982 CAUBO guideline (CAUBO, 1982) for the estimation. Current and capital expenditures for research were reviewed along with the operating expenditure related to capital investment and the overheads incurred by current or capital funding of R&D.

In round table, all participants were able offer comments and to make recommendations for future work which are presented in the next section.

As one of the changes in the last decade has been a decision by the United Nations (UN) Statistical Commission to treat R&D expenditure as a capital expenditure in the System of National Accounts, some time was spend on reviewing the implications of this and on broader methodological issues which led to additional recommendations.

The slides used by all of the presenters are in Appendix 3.

4 Recommendations

4.1 General recommendations

Workshop participants recommended that:

1. The HERD estimation model be revised to maintain the quality of the estimate and that discussions be held with CAUBO on possible changes to survey questions;

1. While relevance is the data quality indicator of leading interest, there are five others in the quality assurance framework of Statistics Canada (Statistics Canada, 2002). They are: accuracy; timeliness; accessibility; interpretability; and, coherence.

2. The estimation model be simplified, as part of the revision process, and that all assumptions used in the model be based on clearly stated principles and published in the documentation of the model;

3. The terms used to describe the model, such as 'support and maintenance', 'overheads' and 'indirect costs', be defined;

4. The model description, the terms and the definitions be published and, ideally, with sufficient detail to allow the reader to reproduce the estimates from data in the public domain; and,

5. The model include estimates of sponsored and non-sponsored research and of indirect costs for all universities, hospitals, and colleges.

4.2 Detailed recommendations

At a more detailed level, participants recommended that:

Data sources for R&D performance and funding

1. The estimation should take a performance approach to HERD, followed by an estimate of source of funds (It was noted that CAUBO takes a funding approach and that this would have to be resolved.);

2. The responses to the CAUBO questionnaire be reviewed to probe consistency of response and to raise the possibility of working with CAUBO to address any inconsistencies;

3. Data sources on R&D in hospitals, both those covered by CAUBO and those not, be reviewed;

4. The annual reports to the Indirect Cost Program be reviewed to see if they could be used in their present form, or in a revised form, to provided information for the estimation process without adding additional response burden on the higher education sector;

Salaries of researchers

1. The methods of estimating researcher time use be reviewed, including the possibility of a time use survey, of taking the estimates from collective agreements compiled by CAUBO, and of any other methods;

2. The salaries of research participants, other than those of professorial rank, be considered for inclusion in the HERD estimates;

3. Sources of salary, or additions to existing salary, such as the Canada Research Chairs program, be examined to determine their impact on HERD estimates;

Indirect costs

1. The 5% estimate for indirect costs be reviewed;

2. Capital expenditure, operating costs and indirect costs involving grants from the Canada Foundation for Innovation, and matching grants, be treated consistently;

New working methods and short term interventions

1. The impact of the Networks of Centres of Excellence and, more generally of collaborative research, on HERD estimates be reviewed;

2. The impact of the Knowledge Infrastructure Program (KIP) on HERD estimates be reviewed; and,

International comparisons

1. The issues affecting international comparisons of HERD estimates and HERD/GDP ratios be reviewed and documented.

4.3 Establishment of a working group

Participants recognized the complexity of the recommendations and the need to proceed in a coherent manner to a revised estimation procedure. To support the process they recommended that:

1. A working group be established to review the recommendations of the workshop participants and to recommend and cost the implementation of a revised method for estimating HERD and its related variables.

5 Next steps

The establishment of a working group to review all of the recommendations in Section 4 and to recommend the means for addressing them is not without cost as the Working Group would require a commitment of time from Statistics Canada personnel and from participants from outside of the agency. It would also require the support of a Secretariat to gather materials and to produce the report. However it need not be as comprehensive in its review as the previous working group (Brochu, 2000) as some parts of the estimation procedure have not been influenced by the changes over the last decade.

Two broad principles could guide the working group. The first is to address those parts of the estimation procedure that have been most affected by changes to funding of higher education and which are likely to have the most impact on HERD. The second is to follow recommendation 4.1.2 and to simplify the estimation procedure so that it, and the data supporting it, are more accessible to the higher education community.

The report of the working group should include cost estimates and options for revising the method of estimation. Implementing the recommendations of the working group could involve substantial costs and its terms of reference, were it to be established, should include a requirement to propose work plans of different time durations and with different cost implications for Statistics Canada. This exercise would have to be guided by the priorities of Statistics Canada.

The Chief Statistician of Canada (Sheikh, 2009) has made clear that the priorities of Statistics Canada for data are: relevance; quality; and, efficiency in their production. There is no question about the relevance of HERD statistics to the public discourse in Canada and internationally. The significant changes in the last decade to the means of support and performance of R&D in the higher education sector pose a threat to the quality of the estimates used in the public discourse. Finally, all of the recommendations assume that the estimates will continue to make extensive use of administrative data to ensure a minimum of burden upon institutions in the sector and efficiency in the use of administrative data in the estimation of the HERD components.

6 References

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Appendix I — Technical workshop

Agenda

Estimates of Research and Development in the Higher Education Sector (HERD)

8:30-9:00	Registration & coffee
9:00-9:30	**Introductory remarks**
9:00-9:10	Welcome - Marcelle Dion, Director General Agriculture, Technology and Transportation Statistics, Statistics Canada
9:10-9:30	Objectives of the day - Fred Gault, Workshop chair Professorial fellow at United Nations University of MERIT in Maastricht
9:30-10:10	**Review of current HERD model methodology**
9:30-9:50	HERD model assumptions - Daood Hamdani, Special Advisor to Statistics Canada
9:50-10:10	Update on 2000 working group recommendations and overview of current status of HERD model – Cindy Carter, Unit Head, Science and Technology surveys
10:10-10:40	**Break**
10:40-12:00	**Round table** Participants will raise issues from the reference material they will have reviewed, and will identify and comment on key interests or concerns
12:00-1:00	**Working lunch**
1:00- 3:15	**Presentation / Panel discussion** - National Accounting practices, indirect costs and other issues Pierre Therrien, Chief – Organisation for Economic Co-operation and Development Erwin Diewert, Professor of Economics – University of British Columbia Karla Fox, Methodologist – Social Survey Methods Division, Statistics Canada
3:15-3:45	**Break**
3:45-4:30	**Synthesis of events and recommendations** Workshop chair
4:30	Adjournment

Appendix II — Participants

Names and Biographies:

BENHAMADI, Bey (Instituts de recherche en santé du Canada - IRSC): *Bey.Benhamadi@cihr-irsc.gc.ca*
Bey Benhamadi holds a Ph.D. in Demography from the University of Montréal. He is currently Manager, Data Analysis and Impact Assessment, at the Canadian Institutes of Health Research.

He has worked at a number of federal agencies, including Statistics Canada, the Treasury Board Secretariat, the Public Service Commission and the Canada Public Service Agency. Bey speaks several languages, including French and English.

CHADWICK, Judith (University of Toronto): *j.chadwick@utoronto.ca*
Judith Chadwick is Executive Director, Research Services, within the Office of the Vice-President – Research, University of Toronto. Judith has served in various roles in research administration over more than twenty-five years. She has served on the Executive of the Canadian Association of University Research Administrators, chairs the the National Administrative Committee of Compute/Calcul Canada and was the inaugural chair of the Operations Working Group of the Ontario Council on University Research. She is currently completing a Masters of Higher Education Leadership program at OISE/UT and was a contributor to *Taking Public Universities Seriously* [2005, F. Iacobucci and C. Tuohy (Eds.), Toronto: University of Toronto Press]

DEW, George (Canadian Association of University Business Officers - CAUBO): *gdew@CAUBO.ca*
George Dew has held the position of Senior Analyst for the Canadian Association of University Business Officers since 2007. In that role he provides support to CAUBO's member committees in a range of disciplines and is responsible for a number of key surveys and reports, notably the FIUC, the annual University Investment Survey and, in collaboration with APPA, the Facilities Performance Indicators report for Canadian institutions.

Prior to joining CAUBO, Mr. Dew worked in research administration at a major Canadian university, with previous experience in project management, consulting and product development. He holds a B.Sc. in Electrical Engineering from the University of Alberta and an MBA from the University of Ottawa.

DOYLE, Ken (Polytecnics Canada): *kdoyle@polytechnicscanada.ca*
Originally from New Brunswick, Mr. Doyle holds an M.A. in Public Administration and a Bachelor's degree in Public Affairs and Policy Management from the Arthur Kroeger College of Public Affairs at Carleton University in Ottawa. Mr. Doyle joined Polytechnics Canada in October 2005 after holding a variety of positions in the aviation industry. As Director of Policy, Mr. Doyle is responsible for the association's policy development and analysis on a range of issues relating to higher education in Canada. Mr. Doyle anchors Polytechnics Canada's expert group of Vice Presidents of Research and provides ongoing institutional research gathering and statistical analysis for the association.

GRÉGOIRE, Pierre Étienne (Ministère du Développement économique, Innovation et Exportation - MDEIE): *PE.Grégoire@mdeie.gouv.qc.ca* Ph.D. Economics (Cambridge, UK). Working from August 1987 to present in the Quebec ministry responsible for research (ministère responsable de la recherche). Current position: senior policy analyst

HENRIE, Isabelle (Canada Foundation for Innovation - CFI): *Isabelle.Henrie@Innovation.ca*
Isabelle Henrie is the Manager, Financial Monitoring at the Canada Foundation for Innovation (CFI) and joined the CFI in December 2002. Amongst other things, she is responsible for overseeing the planning and performance of monitoring activities, including contribution audits and financial review visits at institutions. Before joining the CFI, Isabelle worked at Ernst & Young, an accounting firm, where she received her Chartered Accountant designation and performed several financial audits.

HUBERT, Daniel (Association of Universities and Colleges Canada - AUCC): *dhubert@aucc.ca*
Daniel Hubert, is a Senior Policy Analyst in the Research and Policy Analysis Division at the Association of Universities and Colleges of Canada (AUCC). A member of the AUCC team for six years, Daniel's work has focused on the analysis and use of data related to research and higher education including comparisons within and between provinces, and between Canada and other countries. Daniel was a key contributor to both AUCC *Momentum* publications which, collectively, detail the progress of research investments in Canada over a period of 10 years. Daniel has also contributed to AUCC's most recent edition of *Trends* publications which examine changes in student enrolment, faculty and university finances over the last two decades. Daniel holds a B.A. (Geography) and an MBA from the University of Ottawa.

KEALEY, Gregory (University of New Brunswick): *gkealey@unb.ca*
Dr. Gregory Kealey has been Vice-President (Research) of UNB since December 1, 2001. On July 1, 2008 Dr. Kealey was also appointed University Provost. Before joining UNB, he was Dean of the School of Graduate Studies at Memorial University of Newfoundland. His career as an academic and academic administrator has involved extensive work in graduate studies and research, a distinguished record of scholarship and many accolades. At UNB, Dr. Kealey is drawing on his knowledge and experience to promote and encourage research initiatives, to connect researchers with larger national and international communities so they may realize their own goals, and to increase research funding from government agencies, programs and industry.

Over the past 30 years, Dr. Kealey has received numerous grants, fellowships, prizes and appointments, including visiting professorships and being named fellow of the Royal Historical Society in 1983 and fellow of the Royal Society of Canada in 1999. His contributions to scholarship include serving as founding editor of *Labour/Le Travail* for 21 years and as general editor of the *Canadian Social History Series* with over 30 volumes published to date. He has published four books, edited 26 others, written 22 chapters for books, published 32 articles in refereed journals with 20 articles reprinted, and delivered over 200 papers and commentaries.

In March 2005 he was appointed to the governing body of the Social Sciences and Humanities Council of Canada. He is currently a member of SSHRC's Executive Committee and is Chair of its Standing Committee on Research Support. He is also a member of the Industry Canada University Advisory Committee and of the National Research Council's Institute of Information Technology Advisory Board. In his role as VP Research at UNB he chairs the Board of Enterprise UNB, the university's incubator facility. He also chairs the Advisory Boards of the Canadian Research Institute for Social Policy, the Canadian Rivers Institute, and the Institute for Biomedical Engineering. Outside UNB, he is President of Knowledge Park Inc., a Fredericton Science Park, and serves on the boards of BioAtlantech, King's Landing, Muriel McQueen Fergusson Centre for Family Violence Research, Potato Research Cluster, Research Productivity Council, and Team Fredericton.

KHAROUBA, Alex (Canada Foundation for Innovation – CFI): *Alex.Kharouba@Innovation.ca*
Alex Kharouba is the Analyst, Awards Financial Administration at the Canada Foundation for Innovation (CFI) and joined the CFI in May 2006. Amongst other things, he is responsible for the administration of awards payments, and the preparation and maintenance of the cash flow forecasts. Before joining the CFI, Alex obtained his bachelor of commerce degree at the University of Ottawa.

LACHANCE, Carole (Association of Universities and Colleges Canada - AUCC): *clachance@aucc.ca*
Caroline Lachance is a Senior Policy Analyst in the Research and Policy Analysis Division at the Association of Universities and Colleges of Canada (AUCC), a position she has held for 11 years. Caroline's work has focused on analyzing data on university enrolment, university finance, funding for research and faculty and drawing comparisons between provinces in Canada and between Canada and other countries. Caroline was a driving force behind the last two editions of each of the AUCC publications *Trends* and *Momentum;* she provided both policy analysis and comparisons to illustrate the changes that are taking place in the Canadian postsecondary environment. Caroline holds a B.Sc. from Carleton University.

LACIAK, Barney (Natural Sciences and Engineering Research Council of Canada- NSERC): *Barney.Laciak@nserc-crsng.gc.ca*
Barney Laciak is currently the Senior Planning Analyst within the Policy and International Relations division at the Natural Sciences and Engineering Research Council of Canada (NSERC). Mr. Laciak has worked at NSERC for twenty-years and has a long history in the area of higher education R&D estimates. He participated in the 1999 and 2001 studies aimed at improving the estimates. Mr. Laciak is also a long-time user of all of Statistics Canada S&T and education data. Barney holds and bachelor's degree in Mining Engineering and an MBA, both from McGill University.

LAPRISE-LAMONTAGNE, Francine (Social Sciences and Humanities Research Council of Canada – SSHRC):
France currently works in the Policy, Planning and International Affairs division of the Social Sciences and Humanities Research Council of Canada as a statistical and planning analyst. Since 1995 she has been he has experience completes S&T Federal Science Expenditures, Culture and Biotechnology since 1995. Francine has a certificate in management from Université du Québec à Hull.

LUKE, Dr. Robert (George Brown College): *rluke@georgebrown.ca*
Robert Luke, Ph.D., is Assistant Vice-President of Research and Innovation for George Brown College. He is responsible for all of George Brown College's applied research programs and activities, as well as institutional research and planning at the College. He is also Chair of the Research Expert Group of Polytechnics Canada and has led the internal metrics and outcomes survey that our members conduct on an annual basis.

Dr. Luke is an experienced researcher and expert at working effectively with diverse groups. His research focuses on the application of innovative technologies in healthcare and education, and the evaluation of outcomes associated with new technology development, adoption and adaptation. Dr. Luke has conducted funded research and development for the Natural Sciences and Engineering Research Council, CANARIE, the Ontario Innovation Trust, Canada Foundation for Innovation, Office of Learning Technologies, Heritage Canada, the Social Sciences and Humanities Research Council of Canada, the Ontario Ministry of Health and Long Term Care, Inukshuk Learning Plan, Health Canada, the Change Foundation, the Canadian Breast Cancer Research Alliance, the Canadian Council on Learning, Human Resources and Social Development Canada, the Office of the Privacy Commissioner of Canada, and numerous institutional grants.

Dr. Luke's experience includes industry-partnered research and development and several commercial technologies and numerous prototypes and spinoffs. His current work includes the development of an Innovation Index whereby the return on investment and return on innovation can be translated into social and economic productivity indicators. Dr. Luke has assumed increasingly senior positions both in research (having been collaborator, co-investigator or principal investigator for numerous, large, multi-institutional grants) and management of research and development programs, at Centennial College, the Princess Margaret Hospital, University of Toronto, and now at George Brown College.

NOWAKOWSKI, Matthew (Université de Montréal): *matthew.nowakowski@umontreal.ca*
Matthew is a chartered accountant with six years of experience in university financial management. He is the Executive Director of Financial Services at Université de Montréal. He also chairs the Finance committee of CRÉPUQ, Quebec's university umbrella organization, and sits on the finance committee at CAUBO and on the Not-for-profit advisory committee of the CICA Accounting Standards Board.

POUSSART, Brigitte (Institut de la statistique du Québec - ISQ): *brigitte.poussart@stat.gouv.qc.ca*
Brigitte Poussart has been part of the ISQ's Science, Technology and Innovation team for approximately eight years now. She has worked on different topics – the use of ICT, patents, scientific publications – to produce and analyze indicators allowing a comparison between Quebec and other economies. For the past three years, her work has focused on research and development indicators, particularly in the business enterprise sector. An economist by training, Brigitte has a bachelor's degree from Laval University and a master's from Queen's University.

RIMBAUD, François (Industry Canada): *Francois.Rimbaud@ic.gc.ca*
François Rimbaud is a senior economist with the Policy Branch (Science and Innovation Sector) of Industry Canada. His area of specialisation is the measurement and metrics of Canada's innovation system. He holds a Master's degree in economics from the Université du Québec à Montréal.

ROBINSON, Nobina (Polytecnics Canada): *nrobinson@polytechnicscanada.ca*
Nobina Robinson was appointed CEO of Polytechnics Canada in May 2009.
She has held progressive appointments in the federal government and non-profit sectors since 1990. Since 2005, she served as Senior Government Relations Advisor, Seneca College with principal responsibility for federal advocacy for one of Canada's largest colleges. Her career in the federal Public Service began in Treasury Board Secretariat, and continued as a Foreign Service officer responsible for a number of Latin American and Caribbean issues, including Cuba, and subsequently the Organization of American States. She was Executive Director of the Canadian Foundation for the Americas (FOCAL) from 1999 to 2002. Mrs. Robinson has a BA from Amherst College, Massachusetts, MA from Oxford University (Commonwealth Scholar 1985-1988), and has pursued post-graduate study at Yale University.

SULLIVAN, Tim (Carleton University): *TimSullivan@Cunet.Carleton.Ca*
Tim Sullivan joined Carleton University as Director of Finance in 1996. From 1982 to 1996 he was employed by McGill University, holding several financial positions, leading up to his appointment to University Comptroller in 1993. He is a graduate of McGill University (B.A., Economics) and a Certified General Accountant (C.G.A.)

Tim is the former chair of the Directors of Finance Committee of the Conference of Rectors and Principals of the Universities of Quebec (CREPUQ), as well as the Council of Finance Officers – Universities of Ontario (COFO-UO) an affiliate of The Council of Ontario Universities (COU).

THOMPSON, Janet (former Statistics Canada employee):
Janet spent 36 years employed at Statistics Canada most of which was in the science field. She worked on all R&D surveys during that time and eventually became responsible compiling the Gross Domestic Expenditures on Research and Development (GERD). She was involved in the estimates of HERD expenditures and Higher Education R&D Personnel estimates since the mid 80's. Janet retired from Statistics Canada in 2007 and now enjoys life with her husband and their 16 year old son. She keeps busy with gardening, baking, curling etc.

TRAUTTMANSDORFF, Christine (Social Sciences and Humanities Research Council of Canada - SSHRC): *Christine.Trauttmansdorff@sshrc-crsh.gc.ca*
Christine Trauttmansdorff is the Director of Policy, Planning and International Affairs at the Social Sciences and Humanities Research Council. Her division includes the corporate statistics unit . Christine joined SSHRC as Corporate Secretary in 2006 following a long career at the House of Commons where she served in a variety of management positions in research, Chamber operations, IT and communications. She holds a Bachelor of Arts degree in English Literature and a Masters in Public Administration, both from Carleton University.

Appendix III — HERD model assumptions

Technical workshop on Estimates of Research and Development in the Higher Education Sector (HERD)

Daood Hamdani, October 16, 2009

Introduction - Slide 2

- HERD in the context of GERD
- Estimates derived from a model based on the 2000 working group recommendations
- Consistent with international standards of science and technology data (Frascati manual)

Sources and relative importance of the components of HERD - Slide 3

- Sponsored research expenditure (SRE) – CAUBO survey (54%)
- Indirect costs associated with sponsored research – estimated by Statistics Canada (23%)
- Salary cost of non-sponsored research expenditure – derived from Statistics Canada surveys (13%)
- Indirect cost of non-sponsored research – estimated by Statistics Canada (6%)
- Hospitals not covered in the CAUBO survey – survey (4%)

Estimation methods and assumptions - Slide 4

- In the HERD model, indirect costs are estimated as a fraction of direct costs
- Quality of estimates depends on
  – Definitions and methods used to compile direct expenditures; and
  – Assumptions underlying the indirect to direct cost ratio

Sponsored research expenditure – (CFI funds) - Slide 5

- Sponsored research expenditure (SRE) includes CFI (Canada Foundation for Innovation) funds. CFI funds are:
  – mostly for capital assets and
  – Leveraged
- There is question about whether indirect cost should be calculated on capital expenditures
- Matching CFI administrative data with CAUBO survey difficult because of accounting differences.
- Main issues:
  – To determine the amount of embedded CFI and matching capital funds
  – To what extent are Frascati and CFI definitions of capital consistent?

Sponsored research expenditure – (5% indirect costs) - Slide 6

- Exact amount of indirect costs embedded not known
  – CAUBO survey only identifies federal government grants
  – Some respondents do not report indirect cost recoveries

- Methodology assumes embedded indirect costs are 5% of SRE; federal reimbursements treated separately

- Main issues:
  – Is the assumption that indirect cost recoveries from non-federal sources amount to 5% of SRE fair? If no, how do we arrive at a new estimate?
  – Can one ratio apply to every province and territory? If no, how should they be determined?

Salary cost of non-sponsored research - Slide 7

- Calculated as (faculty research time coefficient x faculty salaries – salaries covered under SRE)

- Faculty research time coefficients are from the 2001 faculty time use survey

- Main issues:
  Relevance
  – Government and university initiatives to enhance research capacity
  • Canada Research Chairs;
  • increase in research grants
  • University initiatives and faculty's interest in research
  Survey coverage
  – Only academic staff covered. Should full-time researchers not in academic departments, including post-doctoral fellows be covered?
  – Should there be criteria for selecting universities?

Calculation of indirect to direct cost ratio - Slide 8

- The ratio is based on expenditures from three funds and is defined as follows
  – Indirect cost equals:
  • a fraction of General Operating Fund expenditures (GOF) +
  • a fraction of Special Purpose and Trust Fund expenditures (SPTF) +
  • Indirect cost embedded in sponsored research expenditures
  – Total cost = (GOF + SPTF + sponsored research expenditure)
  – Direct cost = total cost – indirect cost
  – Indirect cost ratio = indirect cost / direct cost

- Main issues:
  – Some of the derivations are based on a 1982 study. Are those cost relationships still valid today?
  – Is university indirect cost ratio fairly representative of the operating cost of research activity?

Appendix IV — Review and update on 2000 working group recommendations

Presentation to HERD technical workshop

Cindy Carter, October 16, 2009

Outline - Slide 2

- Why and how? Background and framework of working group
- What were the working group recommendations on HERD
- Recommendation outcomes for sponsored research and other costs of research
- Future recommendations of working group
- Discussion

Why - Slide 3

Background on working group

- Convened in September 1999
- Mandate of working group was to develop a framework to improve:
  - Higher education R&D estimates and health gross domestic expenditures on R&D, including R&D personnel
  - The dissemination of information on higher education and health R&D
- A cost benefit analysis was conducted on the various options and the optimal recommendations provided were mindful of not only additional program costs but also additional respondent burden.

How - Slide 4

Working group framework

- To manage the framework the working group divided into 6 tasks:
  - HERD sponsored research
  - HERD other costs of research
  - R&D personnel
  - Dissemination of information on higher education R&D and personnel
  - Comparisons with the United States
  - Health GERD

What and outcome - Slide 5

Working group recommendations on HERD – sponsored research

- Statistics Canada continue to rely primarily on the annual financial report prepared by the Centre for Education Statistics division from data collected and provided by the Canadian Association of University Business Officers (CAUBO).
  – This recommendation has been followed.

What and outcome - Slide 6

Working group recommendations on HERD – sponsored research (continued)

- Statistics Canada continue to estimate sponsored research in the three fields of health sciences, natural sciences and engineering and social sciences and humanities.
  – This recommendation was followed.

What and outcome - Slide 7

Working group recommendations on HERD – sponsored research (continued)

- Statistics Canada improve its methods to estimate research by field by conducting occasional surveys of typical universities via the research office, not the finance office, to obtain estimates of research funding by field.
  – Due to lack of funding, this recommendation was not followed.

What and outcome - Slide 8

Working group recommendations on HERD – sponsored research

- The CAUBO Finance committee agreed to review the guidelines to institutions and work on other improvements to the Annual Financial Report of universities. It also agreed to recommend to CAUBO the following:

- That universities provide more institutional detail in the Financial report to aid Statistics Canada in identifying which research hospitals and institutes are included.
  – Hospital data is arrived at through a combination of Education Statistics Data and CAUBO.

- To identify funding from the Canada Foundation for Innovation (CFI) as sponsored research.
  – Recommendation incorporated in CAUBO form. CFI can only be allocated to sponsored research not capital.

What and outcome - Slide 9

Working group recommendations on HERD – other costs of research

- Statistics Canada revise the method to estimate costs of research borne by the institutions themselves and replace it by an estimation of indirect costs of research and an estimation of faculty member salaries.
  – These recommendations were followed.

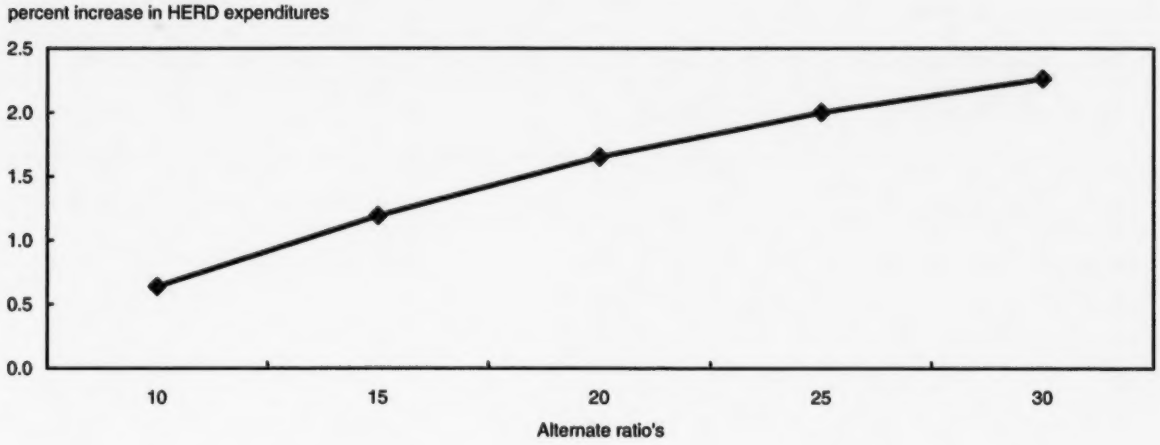
How - Slide 10

Other costs of research: Indirect costs

- The indirect cost of research estimation is calculated by a detailed model and attains a ratio of indirect cost to direct cost for 3 university size categories: small, medium and large. This is used to calculate indirect costs on non-sponsored research.

- An increase in the 5% indirect cost ratio applied to sponsored research from 5% to 10% increases HERD expenditures by less than 1%. An increase to 30% increases HERD by 2.3%.

Chart 1
Influence of increase in 5% ratio on HERD total



How - Slide 11

Other costs of research: Indirect costs (continued)

- The removal of CFI plus matching contributions from the calculation of indirect costs reduces HERD expenditures by 2% or about $200 million dollars.
- The removal of the Indirect Cost Program from the calculation of indirect costs within sponsored research decreases HERD expenditures by less than one percent or $80 million dollars.
- The removal of granting council allocations (i.e. SSHRC) to scholarships and grants for postgraduate students reduces HERD by 3% or around $300 million dollars.

How - Slide 12

Other costs of research: Faculty member salaries

- To attain an estimate for the amount of time faculty members devote to research Statistics Canada uses the "time use survey" which also categorizes universities into small, medium and large groups based on broad discipline.
- A 10 percentage point increase applied to the estimate of research time by faculty members across all size categories translates into a 7% increase in the value of HERD, which for 2007 would be around $750 million. Correspondingly a 20 percentage point increase applied to the time use survey coefficients would increase HERD by 15%.

Suggestions - Slide 13

Future recommended work on HERD sponsored research

- The working group recommended:
  – The expansion of CAUBO data to include information by broad discipline and the distinction between grants and contracts.
  • No work in this area to date.
  – Statistics Canada start collecting data on college R&D (through financial data on colleges collected by the Centre for Education Statistics) and include them in HERD.
  • Work on this has commenced.

Suggestions - Slide 14

Future recommendations on sponsored research: Colleges

- The Association of Canadian Community Colleges (ACCC) claim that over 50% of its members are involved in applied research and perform annually between $100 - $110 million.
- But applied research is only one of three types of R&D outlined in OECD's Frascati manual. There is also basic research and experimental research.
- In addition ACCC's claim does not distinguish between sponsored research or non-sponsored research.

Role of colleges – Examples of funding for R&D - Slide 15

- The College Research Development Fund (CRDF) was designed to help Canadian colleges, institutes, and their affiliated research centres develop and strengthen their research infrastructure through CFI funding.
- The College and Community Innovation (CCI) program of NSERC provides funding to colleges on a competitive basis to strengthen their applied research capacity and carry out applied research and technology transfer activities in one area where the college has recognized expertise and that meet local or regional needs.

Appendix V — HERD considerations

HERD considerations

Pierre Therrien, Principal Administrator, Industry Canada, Organisation for Economic Co-operation and Development

1. What Frascati says - Slide 2

Frascati recommends to:

- Include **all direct grants and contributions** from external organizations:
  – This should not pose any particular problem as that information is believed to be included in the university account system.
- Estimate **indirect government contribution** to the higher education
  – A significant part of the funding of R&D is given as general university funds, not necessarily earmarked for research.
- Adjust HERD overall expenditures to reflect **"full market cost"** of R&D carried out.
  – No specific recommendations given the multitude of arrangements.

The Frascati Manual is an OECD document providing guideline to compile R&D data

2. Canada HERD methodology - Slide 3

Follows Frascati's guidelines by including three major items

1. Sponsored research (~ 60% of HERD: $6B)
   – Money trail: strong foundation for this item (CAUBO + NHEX).
2. Non-sponsored research (~ 15% of HERD: $1.5B)
   – No "R&D block funding" =>need to estimate this item (FTU Survey)
   – FTU Survey: old; do not focus on **non-sponsored research time** but nevertheless useful...
3. Indirect costs (~ 25% of total HERD: $2.5B)
   –**Simplified formula**: 95%*[eligible research*I/D ratio]
   • Several (!!) assumptions in computation of indirect cost.

3. Indirect costs (incurred by university) - Slide 4

(~) Exact formula for indirect cost of **sponsored** research:

{95%*[(Sponsored_Res – CRC)*I/D_ratio]} – Fed indirect cost pgm

Where CRC (Canadian Research Chair): removed because mostly wages and;

I/D_ratio is the I/D ratio of operating an university (computed by univ. size)

Federal Indirect cost program: removed because not incurred by university.

(~) Exact formula for indirect cost of **non-sponsored** research:
100%*[(Non-sponsored_RES)*I/D_ratio]

All non-sponsored research is eligible and universities must cover the totality of indirect cost.

The I/D ratio is the same for sponsored and non-sponsored.

3. Indirect costs (incurred by university) - Slide 5

(~) Exact formula for indirect cost of **sponsored** research:

{95%*[(Sponsored_Res – CRC)*I/D_ratio]} – Fed indirect cost pgm

Assumption 1: 5% of sponsored research is already covered by contracts, meaning that the remaining cost (95%) are incurred by the university.

Assumption 2: Indirect/direct ratio to operate university = performing R&D.
*I/D ratio (I/D ratio of operating an university) is computed as:

I= 11%* [instruction and non-sponsored research+ non-credit instruction] + 100%*[library+computing & comm. +administration+ physical plant + ext.relation]
D= Total General Operating – Student services

Ratio calculated separately for small (0.8), medium (0.6) and large universities (0.4).

Ex. For small universities, $1 of sponsored R&D => 0.8$ in indirect cost.

Q: Is there a way to simplify methodology? - Slide 6

- Sponsored research:
  * money trail: only question of what is eligible...
- Non-sponsored research
  * Is there other means than using Faculty Time Use Survey?
- Indirect cost (in order to **adjust** cost incurred vs. full market cost)
  * Computation really complex and sometime hard to understand the rationale (but I am not an accountant!)

Appendix VI — Estimates of Research and Development in the Higher Education Sector (HERD)

National accounting practices and problems

Erwin Diewert, Department of Economics, University of British Columbia, Vancouver, Canada

Technical workshop held at Statistics Canada, Ottawa, October 16, 2009

Introduction - Slide 2

- We will first ask: what are we trying to do when we measure the R&D outputs of the Higher Education Sector?
- We then note that the System of National Accounts 2008 asks countries to capitalize R&D expenditures within the country. What are some of the implications of this capitalization request for the measurement of HERD in Canada?
- Finally, we look at some of the questions that Daood Hamdani asks in his paper on Statistics Canada's current methodology to measure HERD in Canada.

What is an R&D output anyway and how can we value and price it? - Slide 3

Basically an R&D project is an attempt to create:

- An *addition to the general stock of knowledge*, or
- A new *process* (which is less expensive than existing processes which produce the same outputs) or a new *product* (which can be produced at a price where the product is demanded and can cover the cost of production).

The "best" valuation for a new process or product is the discounted stream of increases in final demander utility that will result from the introduction of the process or product; i.e., final demander valuations are "best".

But it is too difficult to work out these final demander valuations so we resort to the methodology which was developed in SNA 1993; i.e., *we value outputs by the value of inputs.*

Slide 4

Given that we can work out the (cost based) value of the R&D inputs that were used in a particular R&D project (and this in itself is not a trivial problem as is seen in Hamdani's (2009) review), then there is still the problem of *pricing the outputs of the project.*

But the outputs of R&D projects are *inherently unique* and thus it is virtually impossible to price these outputs in a consistent manner over time.

Thus the only alternative is to again follow SNA 1993 and set the price of an R&D output equal to a *price index of the inputs* which were used in the "production" of the R&D output.

Thus the interpretation of the "price" of an R&D output is that it is an index of the real costs of the inputs which went into the creation of the R&D output.

What are the costs of R&D in the Higher Education Sector and what are the measurement problems created by SNA 2008? - Slide 5

There are *three major measurement problems* associated with the measurement with R&D costs in the higher education sector:

- The R&D output of universities and other institutes of higher learning is split between
  – Education and training and
  – R&D (the creation of new knowledge);
- SNA 2008 asks countries to capitalize R&D expenditures without giving much guidance on exactly how this should be done.
- SNA 2008 follows SNA 1993 in not allowing for an imputed cost of financial capital tied up in a government production unit (but SNA 2008 does allow for such an imputed cost for market sector production units).

We will take up the first two problems in turn.

How to allocate costs of universities between education and R&D? - Slide 6

Each class of employee needs to allocate their time between education and research. The major classes of employee are:

- Regular faculty by rank and experience;
- Administrators;
- Support staff;
- Research assistants;
- Post doctoral fellows;
- Others.

Expenditures on R&D materials also need to be collected (should be relatively easy compared to other problems).

The physical capital stock of the university also needs to be allocated between educational and R&D uses. How to do this?

- Office space allocated between the two activities according to the time allocations;
- Dedicated classrooms and research space is easy to allocate.
- And for the rest, who knows?

How to allocate costs of universities between education and R&D (continued)? - Slide 7

Once the physical space in the university has been allocated between the two uses, then heating, cooling and maintenance expenditures can also be allocated proportionally to space used.

The current value of the stock of university structures in use can be constructed using the usual perpetual inventory method but there are some additional problems:

- If the university is privately owned, then the imputation for structure capital services is equal to the current estimated value of the structures times the depreciation rate plus an appropriate real interest rate but if the university is publicly owned, then there is no imputation for the cost of capital.

- Thus for a publicly owned university, there is no imputation for the imputed rental opportunity cost of the land it occupies. This omission will lead to an understatement of university R&D.

How exactly should R&D expenditures be capitalized? - Slide 8

There are two issues here:

- What depreciation rate should we use for these capitalized R&D expenditures?
- Given that university investments on structures and equipment may already be capitalized as part of the perpetual inventory estimates for university wide capital services input, should the R&D share of these capital services be recapitalized as part of the point above?

The answer to the first point above appears to be pretty arbitrary at this stage. Best international practice has not yet emerged. But at some stage, the OECD will probably recommend a "conventional" depreciation rate somewhere between 10% and 20%.

The answer to the second point above appears to be "yes". Thus the resulting accounts will be somewhat complex to say the least!

Statistics Canada's current methodology used to measure HERD - Slide 9

- The survey paper by Hamdani gives an excellent overview of the current methodology and asks some key questions for determining the way forward which will be discussed by others.
- My impression is that the current methodology gives a little too much emphasis on the sources of funding for university R&D projects rather than just measuring the overall inputs that go into R&D projects.
- The listing of which expenses are eligible to be included as R&D costs and which are not eligible seems somewhat arbitrary to an outsider like myself but I am sure that there are good reasons for all of these rules.
- Overall, the treatment of capital expenditures with on going operating expenditures is a bit of a mess.
- There is a need to cooperate with the Canadian Association of University Business Officials to see if they are willing to restructure their financial accounts into segmented activities and undertake the necessary surveys of their staff.

Conclusion - Slide 10

Calculating the value of R&D expenditures in the Canadian university and research hospital sectors in a non trivial task!

Some very tentative conclusions:

- Existing surveys are not really adequate for the task. Statistics Canada should endeavour to get the cooperation of either CAUBO or a sample of Canadian universities in order to develop an accounting framework that would allow university budgets to be decomposed into teaching and R&D components.
- Statistics Canada (perhaps in cooperation with other countries) will have to make some more or less arbitrary decisions on what depreciation rate to choose for capitalized R&D expenditures.
- SNA 2008 is not satisfactory with respect to its treatment of imputed interest for government funded establishments.

Reference: A Review of Estimates of Research and Development Expenditures in the Higher Education Sector (HERD) Methodology by Daood Hamdani.

Appendix VII — Data quality: Understanding the impact of assumptions on estimation

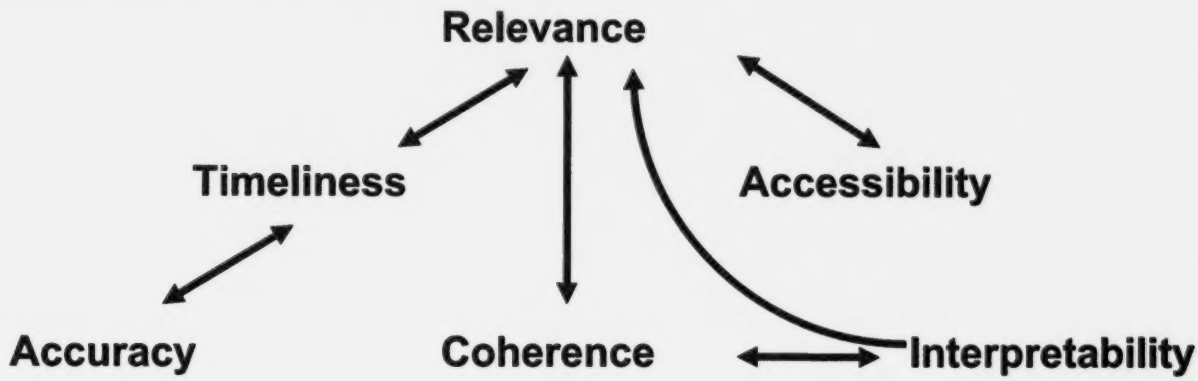
Technical workshop on Estimates of Research and Development in the Higher Education Sector (HERD)

Karla Fox

How to describe quality - Slide 2

- Quality from a user's perspective
- Definition of quality – Fitness-for-use
  - Relevance
  - Timeliness
  - Accuracy
  - Coherence
  - Accessibility
  - Interpretability
- Manage the quality dimensions

Managing quality – Striking the right balance - Slide 3



Data quality evaluation - Slide 4

- Measures related to the project as a whole, not associated with any one particular step
- Certification or validation – final review prior to release

- Studies of the sources of error
- Affects all six dimensions of quality

Data quality evaluation (continued) - Slide 5

- Quality indicators
  - Time lag between reference period and release (timeliness)
  - Gap between objectives and products released (relevance)
  - Completeness of documentation (interpretability)
  - Measures of variability available (for surveys CVs in target range for domains of interest) (accuracy)
  - Comparability to external sources (coherence)
  - Types, formats and cost of products (accessibility)

HERD - Slide 6

- Target population
  - all universities, colleges of technology and other institutes of post secondary education, all research institutes, experimental stations and clinics operating under the direct control of, or administered by, or associated with, the higher education establishments.
- Financial Model
  - Assumptions from data sources, surveys or experts
  - Inputs from Canadian Association of Universities Business Offices (CAUBO) Survey

Data quality evaluation HERD: Studies of the sources of error - Slide 7

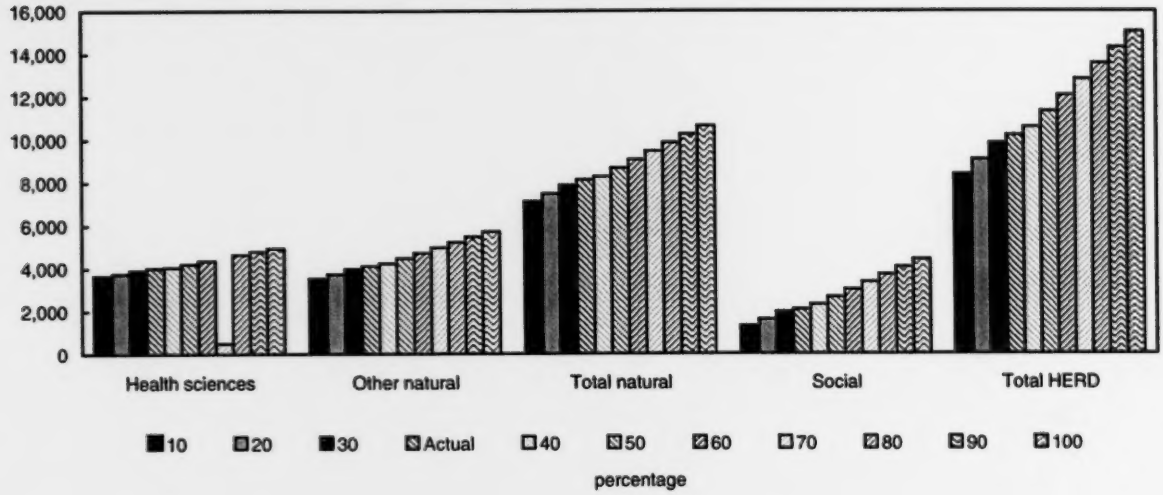
- No overall estimate of variability for the HERD model
- Age of assumptions (accuracy and relevance)
- Reliability of assumptions (accuracy)
- Impact of assumptions on estimation (accuracy)
- Comparability with other studies (coherence)
- Study the sensitivity

Data quality evaluation: Time Use Study - Slide 8

- A Reasoned Sample is not a Probability Sample
- Frame was incomplete
- Estimation method is not clear or well documented
- Variance estimation is also not clear or well documented
- Refusal rate and non-response rate high and not accounted for in estimation
- The estimates derived from this study have a large impact on the final HERD estimate

Sensitivity evaluation: Time Use Study - Slide 9

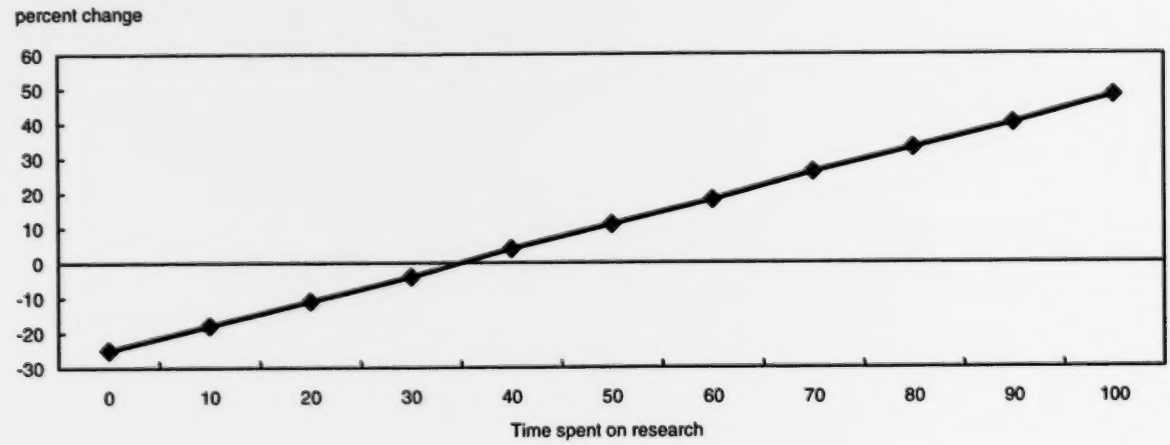
Chart 1
Sensitivity evaluation: Time use study



Sensitivity evaluation (continued) - Slide 10

- If no time is spent on research then the HERD is reduced by 25%
- If 10% of time is spent on research we have a reduction of 18%
- If 50% of time is spent on research we have an increase of 11%
- If 100% of time is spent on research we have an increase of 48%

Chart 2
Sensitivity evaluation



Survey of Intellectual Property Commercialization in the Higher Education Sector - Slide 11

- Target population
  – all members of the Association of Universities and Colleges of Canada (AUCC), as well as the university-affiliated research hospitals
- This survey is a census with a cross-sectional design
- Respondent
  – The survey is mailed to the Vice-President of Research of the university or the CEO of the hospital
- Comparability/Data quality
  – Data on the value of sponsored research (research grants plus contracts) is obtained from the Canadian Association of Universities Business Offices (CAUBO) Survey.

Revision strategy - Slide 12

- Should approach the issue of revision analytically
- Look at the impact on relevance and accuracy of the assumptions
- Address issues of comparability
- Measures related to the project as a whole, not associated with any one particular step